PROGRESS ON THE EUROPEAN GAS TURBINE PROGRAM - AGATA

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ABSTRACT

The four-year European Gas Turbine Program "AGATA" was started in Jan 1993 with the objective to develop three critical components aimed at a 60 kW turbogenerator in an hybrid electric vehicle - a catalytic combustor, a radial turbine wheel and a static heat exchanger. The AGATA partners represent car manufacturers as well as companies and research institutes in the turbine, catalyst and ceramic material fields in both France and Sweden.

This paper outlines the main results of the AGATA project for the first three year period. During the third year of the program, the experimental verification of the components has started. A high pressure/temperature test rig for the combustor and the heat exchanger tests has been built and a high temperature turbine spin rig is now beeing comissioned.

The turbine wheel design is completed and ceramic Si_3N_4 wheels are now beeing manufactured by injection moulding and Hot Isostatic Pressing (HIP). A straight blade design has been selected and FEM calculations have indicated that stress levels which occur during a cold start are below 300 MPa. Cold spin tests with complete wheels are about to start.

The catalytic combustor final design for full scale testing has been defined. Due to the high operating temperature, 1350°C, catalyst pilot tests have included ageing, activity and strength tests. Based on these tests, substrate and active materials have been selected. Initial full scale tests including LDV measurements in the premix duct has started.

The heat exchanger design has also been defined. This is based on a high efficiency plate recuperator design. One critical item is the ceramic thermoplastic extrusion manufacturing method for the extremely thin exchanger plates another is the bonding technique: ceramic to ceramic and ceramic to metal. Significant progress on these two items has been achieved. The manufacturing of quarter scale prototypes is now in process.